ACTIVATING MENTAL REPRESENTATIONS OF ROMANTIC PARTNERS INCREASES CURIOSITY AND EXPLORATORY BEHAVIOR

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ABSTRACT

Although a key proposition of attachment theory is that security-providing attachment figures enhance individuals' curiosity and exploration, the normative effects of adult attachment on exploration have hardly been studied. According to the theory, romantic partners are potential attachment figures in adulthood and adults rely heavily on the mental representation of their partner in addition to face-to-face interactions to regulate felt security. Therefore the aim of the present project was to investigate whether mental representations of romantic partners foster individuals' curiosity and exploratory behavior. In three experiments, we asked participants to complete a supraliminal priming task designed to activate the mental representation of either their romantic partner or social or nonsocial control topics. Following this task, we assessed participants' feelings of curiosity (Study 1) and actual exploratory behavior (Studies 2 and 3). Across the three studies, activating the mental representation of the romantic partner, as compared to control topics, resulted in higher curiosity and exploratory behavior. Moreover, in Study 1 (but not 2 and 3), the effects of the partner prime were only observed for participants who were strongly attached to their partner. Finally, individual differences in adult attachment style did not significantly moderate the effect of the prime in any of the studies. Findings are discussed in terms of the role of mental representations in adult attachment and directions for future research on the adult attachment-exploration link are suggested.

BIOGRAPHICAL SKETCH

Emre Selcuk received his B.S. degree from the Department of Business Administration, Middle East Technical University, Ankara, Turkey in 2003. In 2007 he was awarded a one-year Fulbright Visiting Researcher scholarship to conduct research at the University of Kansas, Department of Psychology. In 2008 he was awarded a scholarship by the Higher Education Council of Turkey for graduate training at Cornell University. He is currently a Ph.D. student in the Department of Human Development.

To Gul Gunaydin, Mualla, Mustafa, and Kerem Selcuk, and Fehmi and Edibe Aysoy

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CHAPTER 1

INTRODUCTION

"All of us, from the cradle to the grave, are happiest when life is organized around a series of excursions, long or short, from the secure base provided by our attachment figure(s)." (Bowlby, 1988, p. 62).

According to attachment theory, (Bowlby, 1982, 1988; Sroufe & Waters, 1977) attachment figures are the primary sources from which individuals derive "felt security". The sense of felt security involves feelings of safety and comfort, and the belief that exploratory activities could be pursued without danger and the attachment figure will be accessible and responsive if needed. When an individual maintains this sense of felt security she or he can optimally engage in exploratory activities aimed at investigating and mastering the environment (Bowlby 1982) and achieving various personal goals. In early life, parents are the primary secure bases from which to explore the world. Indeed, extant empirical evidence demonstrates the role of parents in enhancing exploratory activities during infancy and childhood (Ainsworth, Blehar, Waters, & Wall, 1978; K. E. Grossmann, K. Grossmann, & Keppler, 2005; Sroufe & Waters, 1977; see K. Grossmann, K. E. Grossmann, Kindler, & Zimmermann, 2008, for a review).

As the opening quote illustrates, the theory sees provision of a secure base as essential for optimal exploration not only in infancy and childhood but throughout the entire life span. The theory argues that in adulthood romantic partners become the secure bases from which adults undertake their exploratory excursions (Bowlby, 1979; Hazan & Shaver, 1987, 1994). Despite its centrality to the theory, however, the secure base role of romantic partners has not received much attention from researchers. The

present study examined this issue by focusing on the role of mental representations of romantic partners in enhancing exploration.

The concept of mental representations has a central place in attachment theory, especially in adult attachment. According to Bowlby (1973), individuals form mental representations of attachment figures based on repeated interactions with them. Pleasure-inducing or distress-alleviating interactions with attachment figures, and the associated felt security, are stored as memories and become a part of the mental representation of attachment figures. As individuals mature, they become relatively less dependent on the physical presence of attachment figures and more reliant on the mental representations of them. There are surely times (e.g., during high stress) when mental representations are not sufficient to substitute for the actual presence of attachment figures. However, in daily life, under routine circumstances where reunion with an attachment figure is anticipated, these mental representations are thought to be capable of reactivating psychological and physiological processes originally induced by the actual interactions with attachment figures (Uvnäs-Moberg, 1998), thereby extending and strengthening the benefits of attachment relationships. In line with this view, researchers have suggested that adults, at least in some circumstances, may attain felt security by simply conjuring up the mental representations of attachment figures (Sbarra & Hazan, 2008). Initial evidence on the role of mental representations in adult attachment came from a study (Mikulincer, Gillath, & Shaver, 2002) examining reactions to threatening stimuli. The results revealed that subliminal presentation of threat-related words (i.e., “failure,” “separation”) as compared to a neutral word increased the mental accessibility of the names of attachment figures but not the names of close others who are not attachment figures, names of acquaintances, or names of unknown persons. Although this study did not speak to the issue of whether mental representations of attachment figures serve regulating emotion after

exposure to threatening stimuli, the findings provided evidence that these representations are activated once an adult perceives a threat in the environment. A recent study (Master, Eisenberger, Taylor, Naliboff, Shirinyan, & Lieberman, 2009) provided more direct evidence by showing that these representations have stress-buffering effects. In this study, participants viewed their romantic partner's photograph, the photograph of a stranger, or the photograph of an object while receiving thermal stimulation slightly higher than their pain thresholds. The results revealed that viewing the romantic partner's photograph led to reduced pain ratings as compared to viewing a photograph of a stranger or an object. In the present study, we examined whether mental representations of romantic partners also enhance exploration.

The role of romantic partners in adult exploration has hardly been studied. The few exceptions (Feeney, 2004; 2007; Feeney & Thrush, 2010) mostly focused on how differences in the quality of a romantic partner's support behavior affect an individual's exploratory tendencies and goal-pursuit. For instance, one study found that individuals who discussed their personal goals with a supportive partner showed a bigger increase in their perceived likelihood of achieving these goals compared to individuals who discussed their personal goals with a less supportive partner (Feeney, 2004). Moreover, encouraging and non-intrusive support from a romantic partner while an individual was performing a laboratory puzzle solving task was found to be associated with greater persistence on the task (Feeney & Thrush, 2010). Finally, a longitudinal study (Feeney, 2007) had individuals indicate a personal goal and six months later compared those who achieved their goal with those who did not achieve their goal. The results revealed that participants who achieved a personal goal had romantic partners who were more accepting of the participants' dependence needs as compared to participants who did not achieve their goal. In sum, these studies

documented how individual differences in characteristics of one romantic partner (e.g., quality of support giving, acceptance of partners' dependence needs) affects the exploratory attitudes and goal-pursuit of the other partner. However, they do not speak to the question of whether mental representations of romantic partners have any effect on adult exploration. Receipt of a romantic partner's support when discussing personal goals or engaging in an exploratory activity (Feeney, 2004; Feeney, 2007) is different from relying on the mental representation of the partner during exploration, especially when face-to-face contact with the partner is not always an immediately viable option. Given that mental representations of romantic partners are an important source of day-to-day regulation of felt security (Sbarra & Hazan, 2008) and that adults devote an important portion of their time to various forms of exploration including academic activities (Aspelmeier & Kerns, 2003), work (Hazan & Shaver, 1990), or leisure (Carnelley & Ruscher, 2000), empirically addressing this question is of critical importance for the advancement of adult attachment theory.

Although there may be differences in the types and domains of exploratory goals in adulthood (Aspelmeier & Kerns, 2003; Carnelley & Ruscher, 2000; Feeney, 2007; Hazan & Shaver, 1990), effective pursuit of all these goals often requires curiosity and openness to new information (Ainley, Hidi, & Berndorf, 2002; Carver & Scheier, 1998; Mikulincer & Shaver, 2007; Sansone & Smith, 2000). Curiosity refers to an approach- oriented state associated with novel, challenging, and uncertain events (Kashdan & Silvia, 2009), and is a central component of exploration according to attachment theory (K. E. Grossmann et al., 2005). Information search is another primary aspect of exploration aimed at reducing knowledge deficiencies and subjective uncertainty (Bowlby, 1982; Litman, Rutchins, & Hudson, 2005; Weisler & McCall, 1976). In the present studies, we focused on these two aspects of exploration and examined whether activating mental representations of romantic partners enhances

curiosity and information search behavior. We primed participants with their romantic partner or nonsocial (Study 1) or social (Studies 2 and 3) control topics. Following the prime, we assessed participants' curiosity (Study 1) and information search behavior (Studies 2 and 3). We hypothesized that participants in the romantic partner prime condition would report higher curiosity and engage in more information search behavior as compared to participants in the control conditions.

According to attachment theory, our hypothesis that activating the mental representation of a romantic partner would enhance exploration should apply normatively to all individuals (see also K. E. Grossmann et al., 2005; Feeney, 2007). However, previous research showed that individual differences in attachment style may, at least in some cases, moderate normative relationship processes (e.g., Diamond, Hicks, & Otter-Henderson, 2008; McGowan, 2002; Mikulincer et al., 2002), raising the possibility that the effect of the partner prime might differ between secure and insecure individuals. In addition, chronic or contextually activated attachment style is found to be associated with curiosity, achievement motivation, willingness to engage in exploratory activities, and information search behavior (Aspelmeier & Kerns, 2003; Carnelley & Ruscher, 2000; Elliot & Reis, 2003; Green & Campbell, 2000; Hazan & Shaver, 1990; Mikulincer, 1997). Therefore, we also tested whether the effect of the partner prime is moderated by attachment style.

Another key variable of interest in understanding normative relationship processes is the strength of attachment to the partner. It has long been recognized by infant attachment researchers (e.g., Ainsworth et al., 1978) that attachment style and attachment strength are not the same phenomena. The former refers to qualitative differences in the organization of attachment behaviors toward a caregiver (i.e., secure vs. insecure) whereas the latter refers to the extent to which the infant uses a caregiver to meet attachment needs. For instance, although insecure infants differ from secure

infants in the way they use caregivers to regulate felt security, they are nonetheless attached to their caregivers. It has been argued that the same logic could be applied to adult romantic relationships (Hazan, Gur-Yaish, & Campa, 2004; Sbarra & Hazan, 2008). According to this view, the hypothesized effects of the partner prime should be more pronounced for individuals who are more strongly attached to their partner than individuals who are less so. This view has not received much empirical attention in the adult attachment literature. Thus, in the present series of studies we also tested whether the effect of the partner prime is moderated by strength of attachment to the partner.

CHAPTER 2

STUDY 1

The aim of Study 1 was to investigate whether activating mental representations of romantic partners enhances curiosity. Participants were randomly assigned to the romantic partner condition, in which they completed a supraliminal priming task designed to activate the mental representation of their romantic partner, or to the control condition, in which they completed a similar but nonsocial task. Following this task, participants completed a measure of curiosity. We hypothesized that participants in the partner prime condition would report higher curiosity as compared to participants in the control condition.

Method

Participants. Sixty-nine undergraduate students (53 women, 16 men) who were involved in an exclusive romantic relationship for at least three months participated in the study in exchange for course credit. Mean age of participants was 20 years (*SD* = 1.25) and mean duration of romantic relationship was 22 months (*SD* = 12.68, maximum = 65 months).

Procedure. Participants were randomly assigned to either the partner condition (n = 36) or the control condition (n = 33). Half of the participants completed measures of attachment style and strength before the experimental procedure (i.e., priming task and curiosity assessment) and the other half completed them after the experimental procedure.[1] The experimental procedure and these measures were separated by a filler

[1] The placement of attachment style and strength measures—before or after the experimental procedure—did not significantly affect the scores on these measures or on curiosity.

task consisting of performing a series of one or two-digit simple addition or subtraction operations. Participants in the partner prime condition completed a supraliminal priming task consisting of questions about their romantic partner. Participants in the control condition completed a parallel task consisting of questions about the grocery store they frequent. After completing the priming task participants completed the curiosity measure.

Measures.

Prime. The supraliminal priming task was adapted from Fitzsimons and Bargh (2003). Participants in the partner prime condition were asked to complete a "person memory" task ostensibly measuring one's ability to remember specific information about another person. In actuality, the task was designed to prime the mental representation of the romantic partner. The first question asked participants to visualize and describe their romantic partner's appearance as fully as possible. The last question asked participants to visualize and write about spending and enjoying a day with their romantic partner. The other questions asked about the romantic partner's age, birthday, leisure time activities, and musical preferences.

Participants in the control condition were asked to complete a "place memory" task ostensibly measuring one's ability to remember specific features of and events associated with a place. The first question asked participants to visualize the grocery store they usually go to and describe how it looks like inside as fully as possible. The last question asked participants to visualize and write about the path they commonly take to this grocery store. The other questions asked about the location of the store, the kinds of groceries sold, the time it takes to go to the store, and the frequency of grocery shopping. Participants in both conditions were given six minutes to complete the task.

Attachment style. Participants completed the short form of the Experiences in Close Relationships Inventory (ECR-S; Wei, Russell, Mallinckrodt, & Vogel, 2007). The ECR-S consists of six items assessing attachment-related anxiety, referring to the extent to which individuals are worried about abandonment by close relationship partners (e.g., "I worry that others won't care about me as much as I care about them") and six-items assessing attachment-related avoidance, referring to the extent to which individuals feel uncomfortable about depending on close relationship partners (e.g., "I try to avoid getting close to others"). Participants answered the items on a Likert scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*) in terms of their general orientation toward close relationships. Wei et al. (2007) found validity of the ECR-S to be equivalent to the original 36-item version of the ECR (Brennan, Clark, & Shaver, 1998). Cronbach's alphas in this study were .75 and .84 for anxiety and avoidance, respectively.

Attachment strength. Participants completed the WHOTO (Hazan & Zeifman, 1994), a self-report measure assessing the strength of attachment to a relationship partner. The measure asks participants to list up to four people who meet the features and functions of an attachment relationship: proximity seeking (e.g. "Person(s) you make sure to see or talk to frequently"), safe haven (e.g., "Person(s) you seek out when worried or upset"), separation distress (e.g., "Person(s) you miss when they are away"), and secure base (e.g., "Person(s) you know will always be there for you). Previous research found that close relationship partners listed for proximity seeking items were often not listed for the other three functions and thus treated safe haven, secure base, and separation distress as indices of an attachment bond (Doherty & Feeney, 2004). Therefore we used the safe haven, separation distress, and secure base items of the WHOTO (eight items) to assess attachment strength in the present study. For each item, the romantic partner received a score of 4 if listed in the first place, a

score of 3 if listed in the second place, and so on. We computed a continuous score for attachment strength to the partner by averaging across the items. This resulted in a possible range of scores from 0 to 4. In the present study, Cronbach's alpha for the scale was .78. The correlations between attachment strength and attachment styles in Studies 1-3 are provided in Table 1.

Curiosity. Participants completed the state subscale of the State-Trait Curiosity Inventory (STCI; Spielberger & Starr, 1994), a widely used self-report measure of curiosity. The scale consists of 10 items (e.g., "I feel like exploring my environment"). Participants answered the items on a Likert scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*) in terms of how they feel "right now, that is at this moment." Cronbach's alpha of the scale in the present study was .90.

Table 1. Correlations among Attachment Strength and Styles in Studies 1-3.

	Study 1			Study 2			Study 3		
	STR.	ANX.	AVO.	STR.	ANX.	AVO.	STR.	ANX.	AVO.
STR.	-	.01	-.18	-	.12	.22	-	-.04	-.29*
ANX.		-	.25*		-	.37**		-	.19
AVO.			-			-			-
M	2.64	3.74	2.38	2.37	3.12	2.19	2.47	3.22	2.25
SD	.85	1.00	1.02	.87	.94	.87	1.02	.98	.92

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. STR. = Attachment Strength, ANX. = Attachment Anxiety, AVO. = Attachment Avoidance

Results and Discussion

Supporting our hypothesis, an independent samples t-test revealed that participants in the partner condition reported higher curiosity than participants in the control condition, $t(67) = 2.38$, $p < .05$, $d = .59$ ($M = 4.96$, $SD = .87$ vs. $M = 4.41$, $SD = 1.07$).

To test whether attachment style or strength moderated the effect of the prime, we conducted a hierarchical regression analysis. We entered the prime (partner = 1, control = -1), attachment anxiety, attachment avoidance, and attachment strength in the first step and the two-way interactions of the prime with attachment styles and strength in the second step. All continuous variables were standardized before being entered into the model. The predicted variable was curiosity. The analysis revealed that the main effect of the prime was qualified by a prime by attachment strength interaction (see Table 2 for regression coefficients). A probe of the interaction (Aiken & West, 1991) revealed that the partner prime increased curiosity when participants' attachment strength to the romantic partner was high, $ß = .53$, $p < .01$, but not when attachment strength was low, $ß = .04$, $p = .82$. The interaction terms between the prime and attachment styles were not significant.

Overall, the findings supported our hypothesis that activating the mental representations of romantic partners would increase curiosity. Moreover, this effect occurred when attachment strength to the romantic partner was high but not when it was low. Attachment style did not significantly moderate the effect of the prime on curiosity.

Table 2. Regression Coefficients Predicting Curiosity in Study 1

	ß	*r*	*p*
Step 1			
Prime	.29	.28	.02
Attachment Strength	.05	.04	.71
Attachment Anxiety	-.01	-.01	.95
Attachment Avoidance	-.14	-.13	.28
Step 2			
Prime * Strength	.27	.25	.03
Prime * Anxiety	.10	.10	.41
Prime * Avoidance	.06	.01	.65

Note. Values under the *p* column refers to the *p* values corresponding to the *ß*s.

Although Study 1 showed that activating the mental representations of romantic partners increased feelings of curiosity, it did not address the question of whether a similar increase would be observed in actual exploratory behavior. Studies 2 and 3 addressed this question.

CHAPTER 3

STUDY 2

The aim of Study 2 was to examine whether activating mental representations of romantic partners increases exploratory behavior. One of the primary goals of exploratory behavior is to acquire new information and knowledge (Bowlby, 1982; Litman et al., 2005; Spielberger & Starr, 1994; Weisler & McCall, 1976). Thus, in Study 2, we used an information search paradigm, previously used by Litman et al. (2005) to measure exploratory behavior. We presented participants with a series of general information questions before the priming task. After the priming task, we gave participants a chance to learn the answers to the questions. The number of questions participants wanted to learn the answers to served as the measure of exploratory behavior.

As in Study 1, participants in the partner prime condition were asked to recall and write about their partner. In contrast to Study 1, which included a nonsocial control condition, Study 2 included a social control condition and asked participants to recall and write about an acquaintance. We hypothesized that participants in the partner condition would exhibit more exploratory behavior as compared to participants in the acquaintance condition.

Method

Participants. Sixty-two undergraduate students (44 women, 18 men) who were involved in an exclusive romantic relationship for at least three months participated in the study in exchange for course credit. Mean age of participants was 21 years (*SD* = 4.02) and mean duration of romantic relationship was 20 months (*SD* = 19.74, maximum = 121 months).

Procedure. Participants were randomly assigned to either the romantic partner condition (n = 30) or the acquaintance condition (n = 32). Participants in each condition first completed measures of attachment style and strength. Then, they were asked a series of general information questions. The general information questions also served as filler between the self-report measures and the experimental procedure. Next, participants completed either the partner prime task or the acquaintance prime task. Then they rated how they felt at the moment. Next, they were told that the experiment was over and they could learn the answers to the general information questions. After they indicated the questions to which they wanted to learn the answer, they were debriefed about the purpose of the experiment and were given the answers to all questions.

Measures.

Prime. The supraliminal priming task was similar to the one used in Study 1. Participants in both conditions were asked to complete a "person memory" task ostensibly measuring one's ability to remember specific information about another person. In the partner condition, the first question asked participants to visualize and describe their romantic partner's appearance as fully as possible and the last question asked to visualize and write about spending and enjoying a day with their romantic partner. The other questions asked about the romantic partner's age, birthday, when they first met their partner, and the length of their relationship.

In the acquaintance condition, participants were asked to think and write about an acquaintance. In line with a previous study using a similar prime (McGowan, 2002), participants were told that an acquaintance referred to "someone who has little impact on your life. This person may be someone you interact with on a regular basis on a superficial level or someone whom you have only met a few times." The first question asked participants to visualize and describe the acquaintance's appearance as

fully as possible and the last question asked to visualize and write about a time when they interacted with this person. The other questions asked about the acquaintance's approximate age, when they first met this person, when the last time they interacted with this person was, and how long they have known this person. Participants in both conditions were given six minutes to complete the task.

Attachment strength and attachment style. Measures of attachment strength and style were the same as in Study 1.[2] Cronbach's alphas were .86 for the WHOTO, .73 for the ECR-S anxiety, and .83 for the ECR-S avoidance.

Mood. Participants responded to the question "How do you feel right now?" on a Likert scale ranging from 1 (*very negative*) to 7 (*very positive*).

Exploratory behavior. Participants were asked 21 general information questions taken from a database normed for probability of correct recall (Nelson & Narens, 1980). The questions were selected to reflect diverse topics including history, literature, arts, geography, science, sports, and entertainment. Seven questions were easy (probability of correct recall ranged from .80 to .92 in Nelson and Narens [1980]; e.g., "What is the capital city of France?"), seven questions were moderately difficult (probability of correct recall ranged from .37 to .61 in Nelson and Narens [1980]; e.g., "What is the last name of the author who wrote the The Old Man and the Sea?"), and seven questions were difficult (probability of correct recall ranged from .04 to .20 in Nelson and Narens [1980]; e.g., "What was the name of the largest Confederate military prison during the civil war?"). For each question, participants were asked to indicate whether they knew the answer or not and to write down the answer if they

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[2] Participants also completed a partner-specific version of the ECR-S. Neither attachment anxiety nor attachment avoidance to the romantic partner significantly moderated the effect of the prime.

knew it. On average, participants answered 14 questions (*SD* = 3.71). The average number of correct responses was 9 (*SD* = 2.44).[3]

Following the prime, participants were given the opportunity to learn information about the answer to each question. Specifically, participants were told that they were free to learn as many answers as they wanted and needed to put a check mark on a list next to each question to which they wanted to learn the answer. They were further told that for each question they wanted to learn the answer, they would listen to an approximately 1-minute commentary, consisting of the answer to the question and some supplementary information. This procedure was developed so that the participants were made aware that information search would require some time investment (see Verplanken, Hazenberg, & Palenéwen, 1992, for a similar approach). In actuality, participants never listened to any commentaries. The number of questions they checked served as the measure of exploratory behavior.

Results and Discussion

The number of correct answers was negatively related to information search, $r = -.22$, $p < .05$. Therefore, we controlled for this variable in our primary analysis. A one-way ANCOVA testing the effect of the prime on exploratory behavior with the number of correct answers as a covariate revealed, as hypothesized, that participants in the partner condition engaged in more information search than participants in the

[3] The number of questions answered and the number of correct responses were not recorded for one participant due to a technical error. The sample mean for the two variables were assigned to this participant.

acquaintance condition, $F(1, 59) = 5.70$, $p < .05$, $d = .61$, ($M = 10.60$, $SD = 5.85$ vs. $M = 7.38$, $SD = 4.93$).[4]

An independent samples t-tests revealed that the partner prime induced higher positive mood than the acquaintance prime, $t(60) = 5.04$, $p < .001$, $d = 1.23$ ($M = 5.90$, $SD = .96$ vs. $M = 4.60$, $SD = 1.07$). However, mood was unrelated to the number of answers checked, $r = .17$, $p = .19$, suggesting that the effect of the partner prime on exploratory behavior was not due to an increase in positive mood. Moreover, when we repeated our primary analysis by adding mood into the model as a covariate, the effect of the prime remained significant, $F(1, 58) = 4.20$, $p < .05$.

To test whether attachment style or strength moderated the effect of the prime, we conducted a hierarchical regression analysis. We entered the prime (partner = 1, control = -1), number of correct responses, attachment anxiety, attachment avoidance, and attachment strength in the first step and the two-way interactions of the prime with attachment styles and strength in the second step. All continuous variables were standardized before being entered into the model. The predicted variable was exploratory behavior. In addition to the main effect of the prime, the analysis revealed main effects of attachment anxiety and avoidance (see Table 3 for regression coefficients). Attachment anxiety was negatively associated with information search behavior whereas attachment avoidance was positively associated with it. In line with Study 1, the interaction terms between the prime and attachment styles were not significant. In contrast to Study 1, however, the interaction term between the prime and attachment strength was not significant either.

[4] We also ran a model including the interaction terms between the prime and number of correct answers, and the prime and mood. These interactions were not significant.

Table 3. Regression Coefficients Predicting Exploratory Behavior in Study 2

	ß	*r*	*p*
Step 1			
Correct Answers	-.18	-.22	.11
Prime	.31	.29	.01
Attachment Strength	.06	.14	.57
Attachment Anxiety	-.25	-.06	.04
Attachment Avoidance	.49	.42	.001
Step 2			
Prime * Strength	-.17	-.08	.15
Prime * Anxiety	.06	.07	.62
Prime * Avoidance	.20	.14	.09

Note. Values under the *p* column refers to the *p* values corresponding to the *ß*s.

Overall, Study 2 replicated and extended the findings of Study 1 by showing that activating mental representations of romantic partners increases exploratory behavior. In contrast to Study 1, however, this effect was not moderated by attachment strength. As in Study 1, the effect was not moderated by attachment style.

The findings also revealed effects of individual differences in attachment style on information search behavior. Specifically, attachment anxiety was negatively associated with information search. This finding is in line with previous research showing that attachment anxiety was associated with lower information search (Aspelmeier & Kerns, 2003), especially when engaging in exploration interferes with an opportunity to engage in social interaction (Mikulincer, 1997). Attachment avoidance, on the other hand, was positively associated with information search in the

present study. This finding is surprising given the previous studies showing that attachment avoidance was unrelated to information search (Aspelmeier & Kerns, 2003) and willingness to engage in intellectual exploration (e.g., taking a class unrelated to one's major, reading a new book; Green & Campbell, 2000). We return to this finding in more detail in the General Discussion.

Information search behavior in Study 2 served general knowledge acquisition. In study 3, we examined whether the partner prime increases information search behavior for the purpose of making a decision.

CHAPTER 4

STUDY 3

In Study 3, we used a paradigm typically used to examine information search strategies in decision making tasks (Payne, Bettman, & Johnson, 1993). We randomly assigned participants to the partner or acquaintance conditions as in Study 2. After the prime, we presented participants with three on-campus meal plan options and asked them to choose one. Participants had available to them twelve pieces of information for each plan (e.g., price, number of meals provided). They were allowed to examine as much information as they wanted before making their decision. The number of unique pieces of information examined served as the measure of exploratory behavior (see Aspelmeier & Kerns, 2003 and Mikulincer, 1997, for adaptations of a similar paradigm to study attachment style differences in exploration). We hypothesized that participants in the partner prime condition would look at more information before making their decision as compared to participants in the acquaintance condition.

Method

Participants. Sixty-three undergraduate students (51 women, 12 men) who were involved in an exclusive romantic relationship for at least three months participated in the study in exchange for course credit. Mean age of participants was 20 years (*SD* = 1.14) and mean duration of romantic relationship was 18 months (*SD* = 13.99, maximum = 72 months).

Procedure. Participants were randomly assigned to either the partner (n = 31) or the acquaintance condition (n = 32). Participants in each condition first completed measures of attachment style and strength. Then, they completed a filler task consisting of performing a series of one or two-digit simple addition or subtraction

operations. Following the filler task, they completed the priming task. Finally, they completed a brief measure of mood and worked on the meal plan task.

Measures.

Prime, attachment strength, attachment style, and mood. The supraliminal priming task and measures of attachment style, attachment strength, and mood were the same as in Study 2.[5] Cronbach's alphas were .86 for the WHOTO, .67 for the ECR-S anxiety, and .77 for the ECR-S avoidance.

Exploratory behavior. Exploratory behavior was assessed using a computerized version of a widely used paradigm (see Payne et al., 1993, for a review) to study information search behavior during decision making. Participants were presented with three on-campus meal plan options and were asked to choose one of them. Each meal plan had twelve attributes (e.g., price, number of meals, places to use the plan) which were available to participants to examine before making their decision. Participants were told that they were free to examine as much information as they wanted before making their decision.

After reading the task instructions, participants saw a 12 x 3 matrix with meal plan attributes on the rows and meal plan labels (Plan A, Plan B, and Plan C) on the columns. To look at information, participants clicked on a cell corresponding to the particular attribute of the meal plan they wanted to learn about. When participants clicked on a cell, the corresponding information appeared on a new screen. Participants were allowed to process the information as long as they wanted before going back to the previous screen to select another attribute. Participants were allowed

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[5] Participants also completed a partner-specific version of the ECR-S. Neither attachment anxiety nor attachment avoidance to the romantic partner significantly moderated the effect of the prime.

to see previously seen information as many times as they wanted. The number of unique pieces of information looked at served as the measure of exploratory behavior.

Results and Discussion

As in Study 2, participants in the partner condition reported higher positive mood than participants in the acquaintance prime condition, $t(61) = 4.26$, $p < .001$, $d = 1.04$ ($M = 5.84$, $SD = 1.10$ vs. $M = 4.56$, $SD = 1.27$). Moreover, mood was negatively associated with information search behavior, $r = -.27$, $p < .05$. Therefore we controlled for mood in our primary analysis.

The effect of the prime on information search was not significant without controlling for mood, $t(61) = 1.04$, $p = .31$, but became significant once we controlled for mood, $F(1, 60) = 6.37$, $p < .05$, $d = .68$. In line with Studies 1 and 2, and as predicted, participants in the partner condition looked at more information than participants in the acquaintance condition, ($M = 25.00$, $SD = 8.91$ vs. $M = 22.75$, $SD = 8.34$).[6]

To test whether attachment style or strength moderated the effect of the prime, we conducted a hierarchical regression analysis. We entered the prime (partner = 1, control = -1), mood, attachment anxiety, attachment avoidance, and attachment strength in the first step and the two-way interactions of the prime with attachment styles and strength in the second step. All continuous variables were standardized before being entered into the model. The predicted variable was exploratory behavior. In addition to the main effect of the prime, the analysis revealed a main effect of mood such that higher positive mood was associated with less information search (see Table 4 for regression coefficients). In contrast to Study 2, neither attachment anxiety nor

[6] We also ran a model including the interaction term between the prime and mood. This interaction was not significant.

attachment avoidance emerged as significant predictors of information search. As in Study 2, the prime did not significantly interact with attachment styles or strength to predict exploratory behavior.

Table 4 Regression Coefficients Predicting Exploratory Behavior in Study 3

		ß	*r*	*p*
Step 1				
	Mood	-.44	-.27	.02
	Prime	.35	.13	.002
	Attachment Strength	.03	.03	.84
	Attachment Anxiety	.06	.04	.64
	Attachment Avoidance	.03	-.01	.82
Step 2				
	Prime * Strength	-.16	-.22	.20
	Prime * Anxiety	.14	.17	.26
	Prime * Avoidance	.17	.32	.20

Note. Values under the *p* column refers to the *p* values corresponding to the *ß*s.

Overall, Study 3 replicated and extended findings of Studies 1 and 2 by showing that activating mental representations of romantic partners increases exploratory behavior in a decision making context as well. As in Studies 1 and 2, the effect was not moderated by attachment style. As in Study 2 but in contrast to Study 1, this effect was not moderated by attachment strength.

CHAPTER 5

GENERAL DISCUSSION

A central postulate of attachment theory is that an available and responsive attachment figure provides a sense of felt security across the life span. Across all ages physical proximity to attachment figures is important. However, in adulthood individuals also rely heavily on mental representations of attachment figures to derive felt security, especially under routine, day-to-day circumstances. Maintenance of felt security in turn enables allocating resources to exploratory activities. Based on this idea, the present study investigated whether activating mental representations of romantic partners—potential attachment figures in adulthood—enhances individuals' curiosity and exploratory behavior. Overall, findings from three studies supported predictions derived from attachment theory. Using nonsocial (Study 1) and social (Studies 2 and 3) control conditions, we found that participants whose partner representations were activated reported higher curiosity and engaged in more exploratory behavior as compared to participants in the control conditions.

The present findings not only extend previous findings on the role of romantic partners in exploratory attitudes and behaviors (Brunstein et al., 1996; Drigotas et al., 1999; Feeney, 2004, 2007; Feeney & Thrush, 2010) but have potentially important implications for understanding the mechanisms through which romantic partners affect individuals' functioning. Security-providing interactions with attachment figures are stored as memories, which in turn may reactivate psychological and physiological processes that parallel those induced by face-to-face interactions with attachment figures (Uvnäs-Moberg, 1998). In addition to actual contact with and support from romantic partners, adults rely on these memories and attachment representations to regulate felt security. Therefore, mental representations of romantic partners play a

central role in extending and strengthening the benefits of romantic relationships. To our best knowledge, the present study is the first to provide support for this idea in the realm of exploration. The findings imply that having reminders of, or just thinking about, one's partner may confer benefits to the individual when pursuing exploratory activities. Furthermore, the present findings imply that close relationships may affect self-regulation (i.e., the ability of the self to change its own responses or inner states; Vohs & Baumeister, 2004), even when relationship partners are not physically present (see also vanDellen & Hoyle, 2010; Master et al., 2009).

The present studies did not support firm conclusions as to whether strength of attachment to the partner influences the effect of mental representations of romantic partners on exploration. In Study 1, we found that the partner prime increased curiosity mainly for participants who were more strongly attached to their partner but not for those who were less strongly attached. In contrast, in Studies 2 and 3 attachment strength did not change the effect of activating the mental representation of the partner on information search behavior. One difference between Study 1 and Studies 2-3 was the type of exploration measure. Study 1 used a self-report measure of curiosity whereas Studies 2 and 3 used behavioral measures of information search. Thus, one post-hoc conclusion is that partner representations foster viewing the self as curious only after an individual becomes strongly attached to the romantic partner. However, partner representations may begin enhancing at least simple information search behaviors as soon as an attachment begins to form— referred to as "attachment-in-the-making" (Zeifman & Hazan, 1997). This conclusion is very speculative at this point and future work is definitely needed.

In none of the studies did attachment style significantly moderate the effects of the partner prime. These findings suggest that enhancement of exploration is a normative function of attachment relationships. Other research has found that

attachment style, in some instances, may moderate normative attachment processes. For instance, Mikulincer et al. (2002) found that individuals, regardless of their attachment style, evidenced higher accessibility to the names of attachment figures in response to the subliminal presentation of the threat word "failure" as compared to a neutral word. However, when the word "separation" was subliminally presented, only individuals who were low on attachment avoidance showed heightened accessibility of attachment figure names. Similarly, Diamond et al. (2008) found that individuals, regardless of their attachment style, showed an increase in sleeping problems and decrease in positive affect in response to temporary job-related separations from their partner. However, only individuals who were high on attachment anxiety additionally showed an elevation in cortisol level in response to separation. Therefore, it is possible that although attachment style does not moderate the effect of romantic partners on enhancing information search behavior, it may do so for other types of exploratory behaviors (e.g., seeking new experiences).

Although the effect of attachment style on exploration was not a primary focus of the present studies (see Aspelmeier & Kerns, 2003; Carnelley & Ruscher, 2000; Elliot & Reis, 2003; Green & Campbell, 2000; Hazan & Shaver, 1990; Mikulincer, 1997, for studies specifically focusing on this issue), Study 2 found attachment style differences in information search behavior. In line with previous studies (Aspelmeier & Kerns, 2003; Mikulincer, 1997), attachment anxiety was negatively associated with information search. Attachment avoidance, however, was positively associated with information search. This finding is surprising given the previous null findings on the relationship between avoidance and information search (Aspelmeier & Kerns, 2003; Green & Campbell, 2000). A. Aron and E. Aron (2006) speculated that attachment avoidance may be associated with self-expansion—e.g., expansion of the knowledge base in the present study—in non-relationship domains. The finding from Study 2

supports this speculation. However, note that Study 3 failed to replicate this finding. Future studies examining the associations between attachment style, motivations for and domains of exploratory behavior, and well-being are likely to shed light on this issue.

The present study has some limitations that should be noted. First, all three studies used the same supraliminal task to prime partner representations. Second, only one aspect of exploratory behavior—i.e., searching for new information—was assessed. We are currently designing and running studies using different methods for priming the representation of the partner and assessing different aspects of exploratory behavior (e.g., trying new experiences). Finally, our participants were predominantly female young adults in committed dating relationships. Thus, caution should be taken in generalizing the findings to males, older adults, and married couples.

Based on the present findings, one avenue for future research includes investigation of possible mechanisms that lead to the observed increase in exploration. For instance, future studies may examine the physiological instantiation of felt security as a possible mediator of the effects observed in the present studies. Vagal tone is one such potential mediator. Cardiac vagal tone is an index of the degree of influence on the heart by the vagus nerve, a primary nerve of the parasympathetic branch of the autonomic nervous system, and has been suggested to be effected by interactions with attachment figures (Diamond, 2001; Sbarra & Hazan, 2008). Three pieces of evidence are needed to show that activating mental representations of romantic partners leads to an increase in vagal tone which in turn enhances exploration. The present study provides the first piece by showing that activating mental representations of romantic partners enhances exploratory behavior. The second piece concerns the link between mental representations of romantic partners and vagal tone. Although direct evidence for this link is missing, indirect evidence

comes from studies showing that strength of attachment to a romantic partner is associated with greater vagal tone (Diamond & Hicks, 2005) and that increases in parasympathetic control can be obtained by consciously focusing on feelings of care and appreciation (McCraty, Atkinson, Tiller, Rein, &Watkins, 1995). Finally, the third piece concerns the link between vagal tone and exploratory behavior. Increased vagal tone was found to be associated with greater exploration in infancy (DiPietro, Porges, & Uhly, 1992). In a recent review of the literature on self-esteem and vagal tone, Martens, Greenberg, and Allen (2008) speculated that greater cardiac vagal tone might be associated with higher challenge appraisal (elicited when one appraises personal resources exceeding situational demands), a precursor of effective exploration (Elliot & Reis, 2003). However, no study has directly tested the effect of changes in vagal tone on adult exploration. Overall, future studies examining whether activating mental representations of romantic partners leads to greater vagal tone and whether changes in vagal tone lead to changes in exploratory behavior would be timely and very valuable for understanding the mechanisms through which adult attachments affect exploration.

Future research should also examine how exploration is effected when the romantic partner becomes unavailable due to separation or loss. Attachment theory predicts that unavailability of a secure base would interfere with exploration. A recent study (Cavallo, Fitzsimons, & Holmes, 2010) found that individuals who wrote about a threat to their relationship showed higher mental accessibility to avoidance-related words (e.g., safety, prevent) and lower accessibility to approach-related words (e.g., eager, progress). To the extent that high approach- and low avoidance-orientation might be indicative of exploratory tendencies this study provides indirect support for the prediction of attachment theory that threats to the availability of a secure base reduces exploration. No study has conducted a direct test of this prediction by

examining changes in exploratory behaviors following imagined or actual separation from a partner. Such studies will be important additions to the body of knowledge about the interplay between attachment and exploration in adulthood.

In sum, we believe that the present study makes a valuable contribution to the adult attachment literature by documenting one role of mental representations of romantic partners in adult exploration. Many interesting research questions await investigation as relationship researchers uncover the interplay between romantic attachments and exploration in adult life.

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